Close to the Heart of Kentucky, 2004

A report on the status of cardiovascular disease in the Commonwealth

Chronic Disease Prevention and Control Branch
Division of Adult and Child Health Improvement
Kentucky Department for Public Health

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Acknowledgements

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in collaboration with

Kentucky Department for Public Health
Division of Adult and Child Health Improvement
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Contents

A word from the Commissioner

This is a request that you read this urgent message and then do what you can to help your area of Kentucky get organized to do something about reducing the risk of heart disease and stroke. As you probably know Kentucky is one of the most unhealthy states in the country because of its obesity, poor diet, sedentary lifestyle, and tobacco use. What you may not realize is that the current and projected cost of treating the accompanying epidemics of heart disease, stroke, diabetes, renal failure, and associated problems is draining public funds from other projects like teacher salaries, improved roads, new schools, support for public universities, as well as dozens of other worthwhile projects.

Kentucky is one of the most unhealthy states in the country because of its obesity, poor diet, sedentary lifestyle, and tobacco use.

In addition to the fiscal downside of these epidemics, one has to wonder where our police departments, fire departments, military, and other professions are going to find the physically fit men and women they need to perform the strenuous work required in these jobs. Finally, the cost of health insurance is driving more and more private sector businesses to drop this coverage for retirees, reduce benefits, increase employee share, and raise co-pays. Health insurance for my wife and me has risen from about $160 per year in 1966 to just over $12,000 today!

This situation does not need to exist — it did not exist 30 years ago — but changing it requires real teamwork. Boards of health, schools, practicing physicians, the Cooperative Extension Service, hospitals, and the state health department can put their heads together to determine the best way to reduce the risk of heart disease and stroke in their region of Kentucky. We have formed coalitions like this in the past to battle tuberculosis (before anti-tuberculosis medication) and polio (before the vaccine), as well as other community-wide problems.

The medical and public health knowledge is out there. The challenge is getting dedicated people to work together to turn knowledge into behavioral change and ultimately into better health for Kentuckians. You can get more information on this subject from your local health department or from the Kentucky Cardiovascular Health Program at (502) 564-7996.

Rice C. Leach, MD

Rice C. Leach, MD

Introduction

Despite decades of declining rates, cardiovascular disease (CVD) remains the number one cause of death in Kentucky and the nation. In 2001, CVD claimed more than 15,000 lives in the Commonwealth, accounting for almost four out of every ten deaths in the state. In fact, CVD claims almost as many lives each year in Kentucky as do cancer, chronic lower respiratory diseases, injuries, diabetes, and influenza and pneumonia combined — the next five leading causes of death (Figure 1). Kentucky's death rate from CVD is 10% higher than that for the U.S. and the fourth highest rate in the nation.

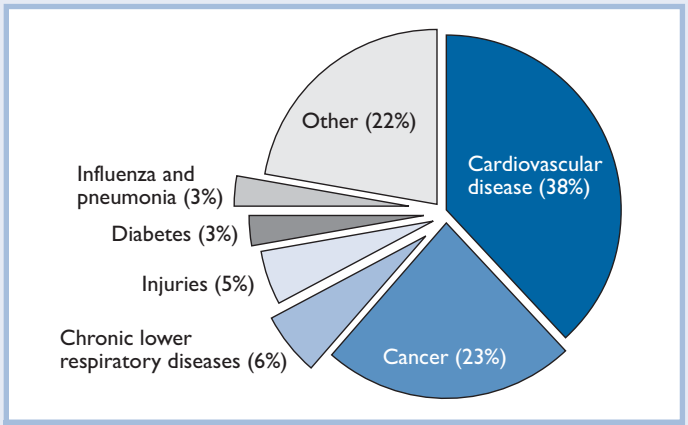


Figure 1. Leading causes of death in Kentucky, 2001 (Source: CDC Wonder).

CVD is a broad term that refers to a variety of diseases of the heart and blood vessels. The two most common forms of CVD are *coronary heart disease*, the disease that causes heart attacks, and *stroke*, the disease that can be justifiably called a "brain attack." Heart disease, including coronary heart disease, causes 78% of CVD deaths or almost 30% of all deaths in the state. Stroke causes 17% of CVD deaths or almost 6.5% of all deaths (Figure 2).

In 2003, more than 90,000 hospitalizations in Kentucky, almost 16% of all hospital stays, were attributable to CVD as a primary diagnosis. Over $2 billion in hospital charges were billed that year for CVD — averaging $22,000 per stay — with $1.3 billion charged to Medicare and $131 million to Medicaid. Clearly, CVD places a great burden on individuals and society alike.

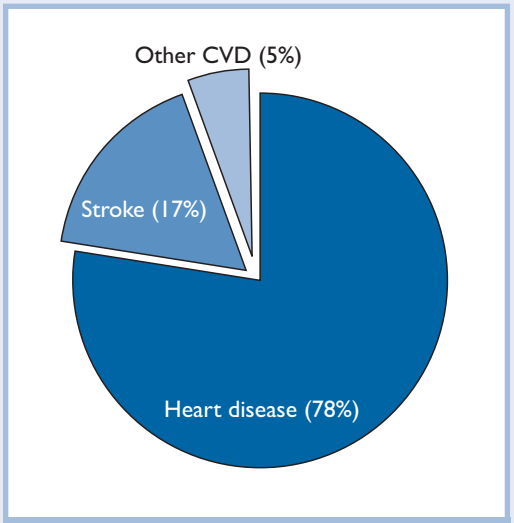


Figure 2. Cardiovascular disease deaths in Kentucky, 2001 (Source: CDC Wonder).

Death rates from CVD are highest among older adults. But despite elevated rates in this group, about one in five deaths from CVD in Kentucky occurs among adults younger than 65. CVD is not just a disease of the elderly; it also strikes many adults during their peak earning years, cutting productive lives short.

Atherosclerosis is the disease process that underlies the major types of CVD. As atherosclerosis advances, the arteries narrow, choking the flow of blood to vital organs such as the heart and brain. Also, as this disease progresses, so does the likelihood that arterial plaques will build up. These plaques can dislodge and create traveling blood clots, causing heart attack and stroke.

Although CVD most often strikes middle-aged and older adults, atherosclerosis begins in childhood. It is vital that prevention efforts address the causes of CVD early on before the effects of the disease are seen in our emergency rooms, nursing homes, and funeral parlors. Fortunately, many risk factors for CVD are under our control. These modifiable risk factors should be at the heart of any CVD prevention strategy, whether adopted by individuals or aimed at the population at large.

The obstacle Kentucky faces in tackling these risk factors is that a large proportion of the adult population already has one or more of the main risk factors for CVD.

- About a third have high blood pressure.
- Nearly a third smoke, the greatest proportion of any state.
- About 25% have high cholesterol levels.
- About 8% are diabetic.
- Nearly 63% are overweight or obese, the sixth highest percentage in the nation.
- About 31% report getting no physical activity, the fifth highest rate in the nation.
- Only 22% eat the recommended number of servings of fruits and vegetables a day.

The situation is equally distressing among Kentucky's youth.

- Almost a third of Kentucky high school students smoke, the highest rate in the nation.
- About 13% are at risk of diabetes.
- About 15% are overweight and another 15% are at risk of being so.
- Nearly 11% report getting no moderate or vigorous physical activity.
- Only 13% eat the recommended number of servings of fruits and vegetables a day.

The numbers alone don't tell the full story. Habits formed during childhood are often maintained throughout life, so the risk factors that Kentucky's youth have embraced may be a predictor of CVD death and disability in the coming decades. Preventive action must be taken now.

One purpose of this report is to coordinate efforts throughout the state to reduce the burden of CVD. Armed with the data in this report, those charged with implementing the state's cardiovascular health plan will gain a more complete understanding of Kentucky's CVD problem and be better equipped to identify groups with disproportionately high rates. Together, we will continue to build upon one another's strengths to lower the incidence of this disease and reduce health disparities across the Commonwealth.

Cardiovascular disease

Cardiovascular disease, or CVD, has long been the leading cause of death in Kentucky and the nation. CVD is a group of diseases of the heart that includes *coronary heart disease*, the disease that leads to heart attacks, and diseases of the blood vessels, which can lead to *strokes* or "brain attacks."

In 2001, more than 15,000 deaths in Kentucky — 38% of all deaths — were from CVD. Put another way, CVD is the cause of one out of every 2.6 deaths in the state. Since 1979, Kentucky has had consistently higher death rates from CVD than the nation as a whole (Figure 3). Although Kentucky's CVD death rate has dropped nearly 35% since 1979, the rates have been, on average, 10% higher than corresponding U.S. rates, a disparity that has grown gradually over the past decade. Today, Kentucky's rate of 392.2 CVD deaths per 100,000 people places the state fourth highest in the country, trailing only Mississippi, Oklahoma, and West Virginia.

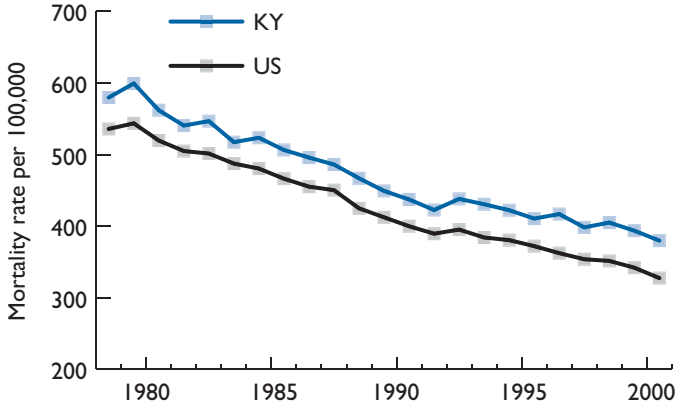


Figure 3. Age-adjusted cardiovascular disease death rates in Kentucky and the U.S., 1979–2001 (Source: CDC Wonder).

Although CVD is often thought of as a disease that primarily affects men, it also affects a large number of women. Men have a higher risk of dying from the disease, but CVD has taken the lives of more women than men every year in the United States since 1984.

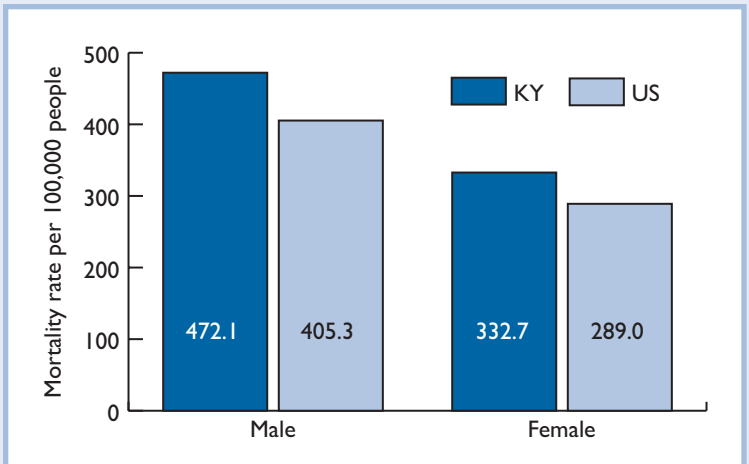


Figure 4. Age-adjusted cardiovascular disease death rates by sex in Kentucky and the U.S., 1999–2001 (Source: CDC Wonder).

That seemingly contradictory finding is explained by examining when CVD occurs in a person's life. For both men and women, CVD is the leading cause of death. And more deaths from CVD occur in women than in men. But *age-adjusted death rates* for CVD — that is, an adjustment made to rates to remove the influence of different age distributions when making

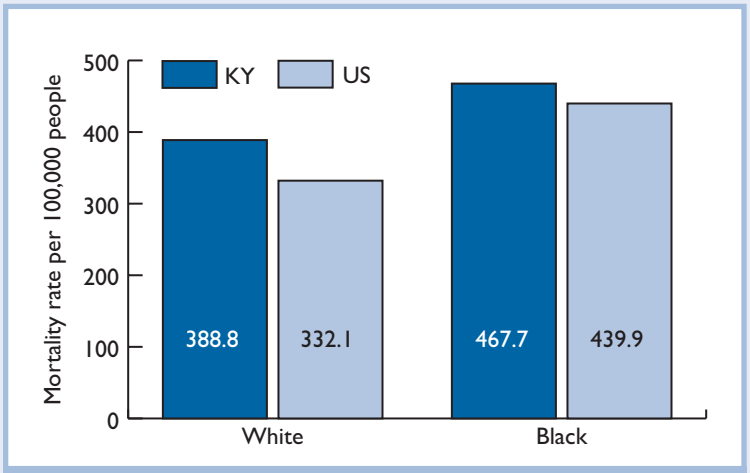


Figure 5. Age-adjusted cardiovascular disease death rates by race in Kentucky and the U.S., 1999–2001 (Source: CDC Wonder).

comparisons between groups — are higher for men in both Kentucky and the U.S. (Figure 4). The CVD death rate for women is lower than for men because more women die from CVD later in life. This is especially true after menopause, when a woman's risk of heart disease and stroke increases steadily with age.

Kentucky men have the third highest CVD death rates in the U.S. and Kentucky women have the fifth highest. This translates to a CVD death rate for Kentucky men that is 16.5% higher than the national rate. For Kentucky women the rate is 15% higher.

The difference in CVD death rates between the state and nation isn't seen only among men and women — it is also observed between blacks and whites. The CVD death rate for white Kentuckians is 17.1% higher than the rate for white Americans. For black Kentuckians, the rate is 6.3% higher than it is for black Americans (Figure 5). In Kentucky, the rate for blacks is 20.3% higher than it is for whites.

As with many diseases, the likelihood of death from CVD increases with age (Figure 6). However, it is important to note the number of premature deaths from CVD — that is, deaths that occur before age 65. About one out of every five CVD deaths in Kentucky occurs in those younger than 65. In 2001 alone, over 2,800 Kentuckians died prematurely from CVD.

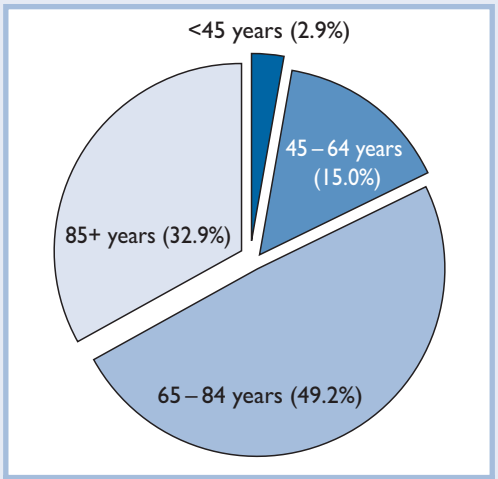


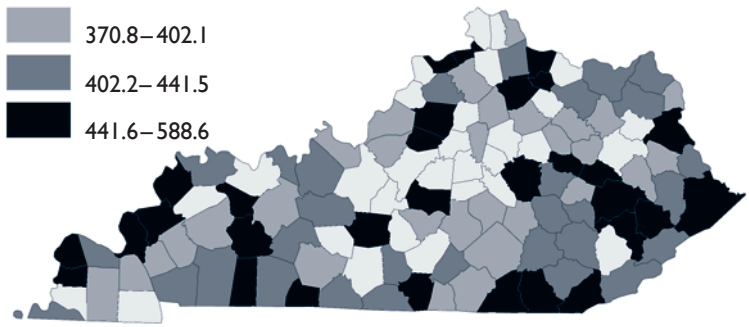
Figure 6. Cardiovascular disease deaths by age group in Kentucky, 1999–2001 (Source: CDC Wonder).

Table 1. Percentage of cardiovascular disease deaths before age 65 in Kentucky, 1999–2001 (Source: CDC Wonder).

Kentucky	17.9%
Males	25.8%
Females	11.1%
White males	25.1%
White females	10.4%
Black males	36.2%
Black females	20.7%

Table 1 shows the percentage of premature CVD deaths in Kentucky by sex and race.

Among men, one quarter of deaths from CVD occur before age 65. Among women, 11% of deaths from CVD occur before age 65. The percentage of premature deaths among black men is nearly 30% higher than among white men. Among black women, the percentage of premature deaths is almost 50% higher than among white women.



Map 1. Age-adjusted cardiovascular disease death rates by Kentucky county, 1999–2002 (Source: CDC Wonder). *Counties darkly shaded have the highest mortality rates and those lightly shaded have the lowest rates.*

CVD death rates vary across Kentucky's counties (Map 1). High rates of CVD are seen throughout the Commonwealth, with the top 25% of county-level death rates being scattered across the state. Table 2 lists the ten highest CVD death rates by county. Appendix A lists CVD death rates for each of Kentucky's 120 counties.

Table 2. Top ten highest county-level age-adjusted cardiovascular disease death rates per 100,000 people, 1999–2001 (Source: CDC Wonder).

1	Ballard	588.6
2	Cumberland	570.2
3	Crittenden	559.1
4	McCreary	549.6
5	Breathitt	539.7
6	Pike	524.2
7	Perry	511.3
8	Carlisle	498.6
9	Wolfe	497.7
10	Robertson	496.8

In 2003, over 90,000 hospitalizations in Kentucky were attributable to CVD (Table 3). This total accounted for almost 16% of all hospitalizations in the state. With an average length of hospital stay at 4.8 days, medical costs for CVD are substantial. Over $2 billion in hospital charges were billed in 2003 alone, averaging almost $22,500 per CVD hospitalization. Of the $2 billion billed, $1.3 billion (62.9%) were charged to Medicare, and $131 million (6.3%) to Medicaid.

See Appendix A for county-level CVD hospitalizations, average length of stay, and hospital charges billed.

Table 3. Cardiovascular disease hospitalizations in Kentucky, 2003 (Source: Health Policy Development Branch, KDPH).

Total hospitalizations	92,089
Average length of hospital stay	4.8 days
Total charges	$2.07 billion
Average charge per hospitalization	$22,486

7 Heart disease

Heart disease, a group of diseases that can cause heart attacks, is the leading cause of death in Kentucky. Heart disease is the most common form of cardiovascular disease (CVD) and in 2001 accounted for nearly 80% of all CVD deaths in the Commonwealth. This translates to nearly 12,000 deaths from heart disease, or about 30% of all deaths in the state.

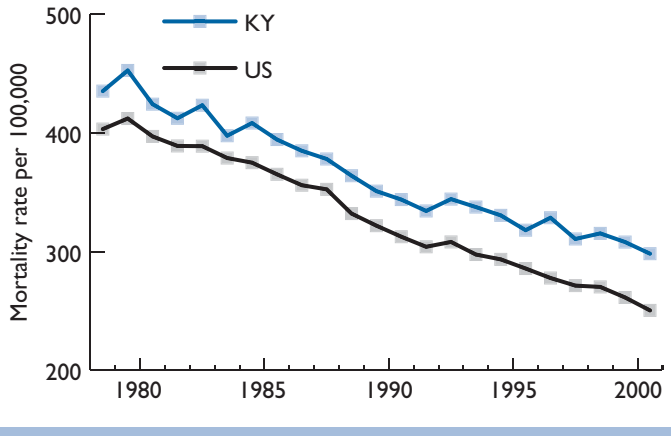


Figure 7. Age-adjusted heart disease death rates in Kentucky and the U.S., 1979–2001 (Source: CDC Wonder).

Figure 7 shows that heart disease death rates in Kentucky have remained consistently higher than U.S. rates, on average about 11% greater from 1979–2001. Over these years, heart disease death rates have declined by over 30% in Kentucky and by nearly 40% nationwide. But despite this sharp decline, heart disease stills causes about 2,500 more deaths a year in Kentucky than cancer, the second leading cause of death. Today, the age-adjusted death rate from heart disease in Kentucky is 302.8 per 100,000 people, placing the state fifth highest in the nation, after Mississippi, Oklahoma, West Virginia, and the District of Columbia.

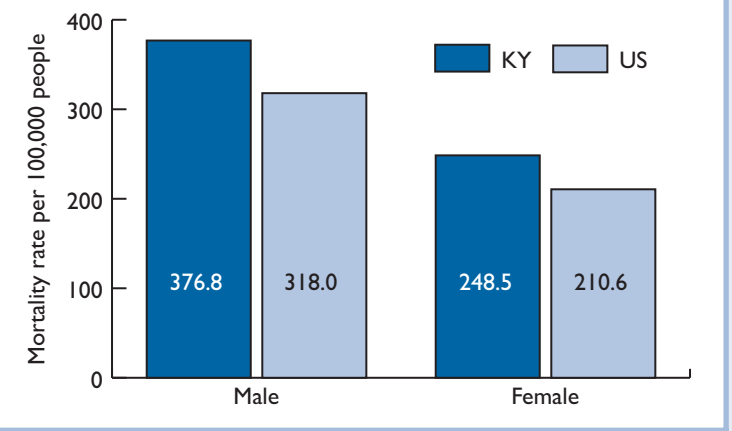


Figure 8. Age-adjusted heart disease death rates by sex in Kentucky and the U.S., 1999–2001 (Source: CDC Wonder).

Men in Kentucky and throughout the nation have higher heart disease death rates than women (Figure 8). The rates for men and women in Kentucky, however, are higher than their nationwide rates. The rate for Kentucky men is 18.5% higher than that of their U.S. counterparts, placing the state fourth highest in the nation. For Kentucky women, the rate is 18% higher than for U.S. women, placing the state sixth highest among all states in the nation.

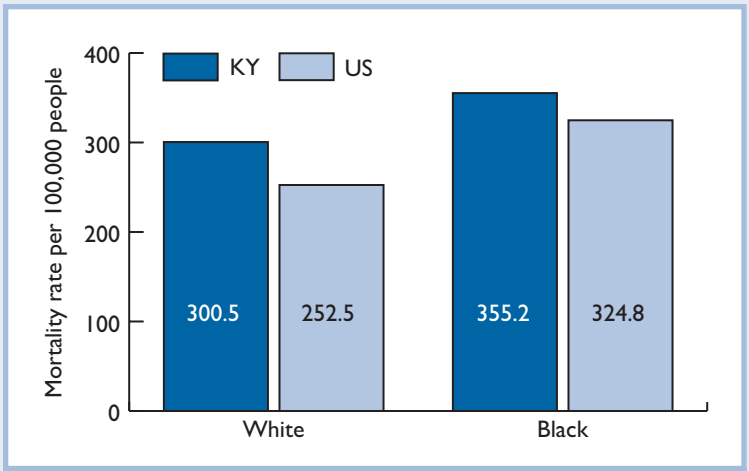


Figure 9. Age-adjusted heart disease death rates by race in Kentucky and the U.S., 1999–2001 (Source: CDC Wonder).

Similar disparities are also seen between whites and blacks. In both Kentucky and the U.S. heart disease death rates for blacks are higher than they are for whites (Figure 9). The death rate for white Kentuckians is 19% higher than it is for white Americans. The rate for black Kentuckians is 9.4% higher than it is for black Americans.

Figure 10 shows heart disease death rates in Kentucky by age group. Like CVD deaths in general, nearly one out of every five heart disease deaths in the state occurs prematurely — that is, occurs in those younger than age 65. National figures are closer to one in six. These premature deaths are not distributed equally among Kentuckians (Table 4). Over 25% of heart disease deaths in men occur prematurely, more than double the percentage of such deaths among women. Black men have the greatest burden of premature death, with more than a third of all heart disease deaths occurring among those younger than 65. The percentage of black women who die prematurely from heart disease is nearly twice that of white women.

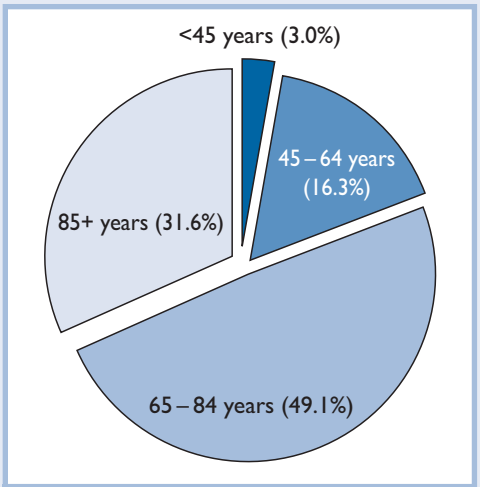


Figure 10. Heart disease deaths by age group in Kentucky, 1999–2001 (Source: CDC Wonder).

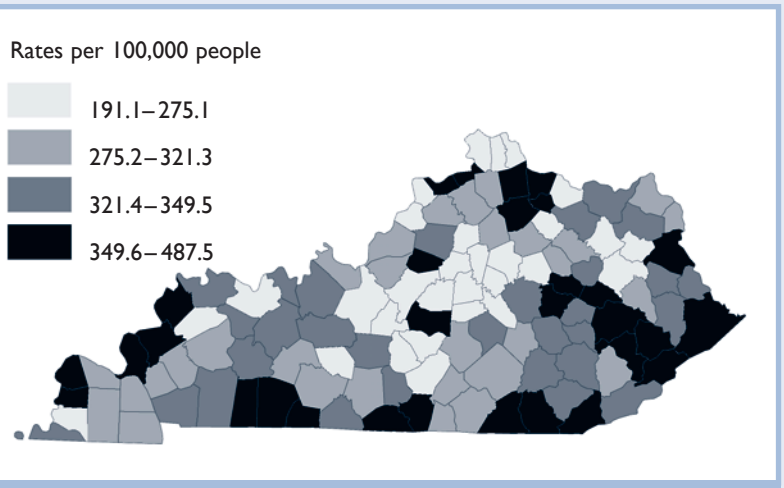
Table 4. Heart disease deaths before age 65 in Kentucky, 1999–2001 (Source: CDC Wonder).

Kentucky	19.3%
Males	27.4%
Females	11.7%
White males	26.7%
White females	11.0%
Black males	38.3%
Black females	21.6%

Counties in Kentucky with the highest death rates from heart disease are widely dispersed throughout the state, but groups of such counties tend to be clustered in eastern Kentucky and along the Kentucky–Tennessee border (Map 2). Conversely, several counties in northern and central Kentucky have some of the lowest heart disease death rates in the state. Appendix B lists

heart disease death rates by county.

In 2003, over 73,000 hospitalizations in Kentucky were attributable to heart disease, a total that accounts for more than 12% of all hospitalizations in the state (Table 5). The average length of stay for those hospitalized with heart disease is 4.6 days. Nearly $1.7 billion in hospital charges were billed in Kentucky for heart disease, averaging nearly $23,000 per hospitalization. Of the total billed, $1.05 billion (62.2%) were charged to Medicare and $107 million (6.4%) to Medicaid.



Map 2. Age-adjusted heart disease death rates by Kentucky county, 1999–2001 (Source: CDC Wonder). *Counties darkly shaded have the highest mortality rates and those lightly shaded have the lowest rates.*

Appendix B lists heart disease hospitalization data for each county in Kentucky.

Table 5. Heart disease hospitalizations in Kentucky, 2003 (Source: Health Policy Development Branch, KDPH).

Total hospitalizations	73,325
Average length of hospital stay	4.6 days
Total charges	$1.68 billion
Average charge per hospitalization	$22,917

Stroke

According to the American Stroke Association, every 45 seconds someone in the U.S. has a stroke and every three minutes someone dies of one. Stroke is the third leading cause of death in Kentucky, ranking behind heart disease and cancer. In 2001, over 2,500 people in Kentucky died from stroke, accounting for 6.5% of all deaths in the state.

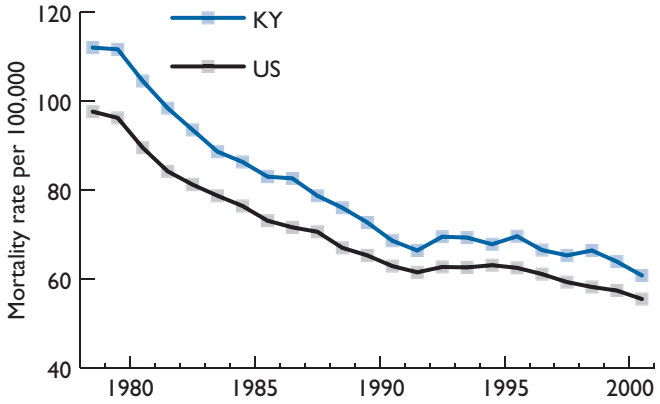


Figure 11. Age-adjusted stroke death rates in Kentucky and the U.S., 1979–2001 (Source: CDC Wonder).

Figure 11 shows stroke death rates for Kentucky and the U.S. from 1979–2001. During that time, death rates from stroke in Kentucky have consistently remained above national figures, averaging 12.2% higher. However, the gap is slowly narrowing as Kentucky's rates have declined 45% during this time, slightly more than the 43% drop seen for the nation. Today, Kentucky's stroke death rate of 67.5 per 100,000 people places the state 12th highest in the nation.

Just as with heart disease death rates, stroke death rates among men and women and among blacks and whites in Kentucky are higher than corresponding national figures. Unlike heart disease death rates, stroke death rates for men and women rank outside the top ten highest among states, at, respectively, 13th and 12th place. In Kentucky and across the nation, little difference among stroke death rates is seen between men and women. But the rates for men and women in Kentucky are, respectively, 10.7% and 13.2% higher than corresponding U.S. rates (Figure 12). Stroke death rates among blacks are 27% higher than among whites in Kentucky and 5% higher than among blacks in the U.S. (Figure 13).

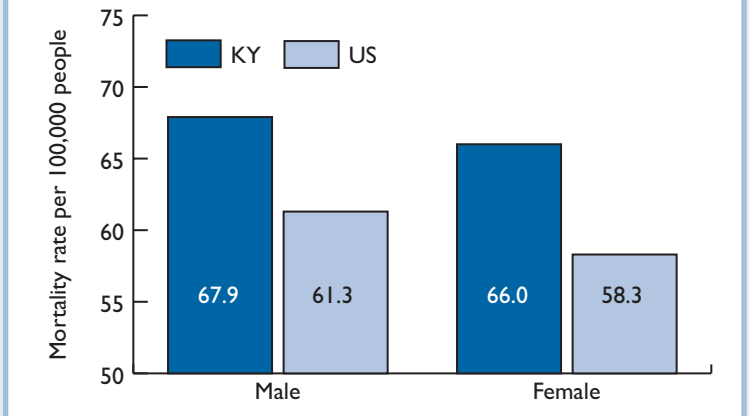


Figure 12. Age-adjusted stroke death rates by sex in Kentucky and the U.S., 1999–2001 (Source: CDC Wonder).

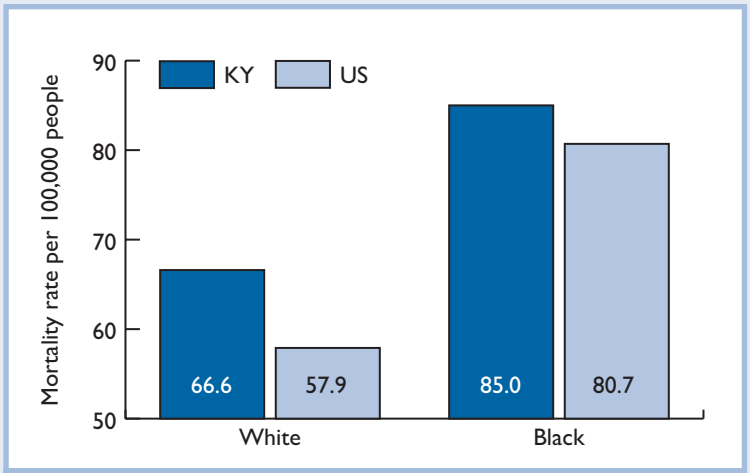


Figure 13. Age-adjusted stroke death rates by race in Kentucky and the U.S., 1999–2001 (Source: CDC Wonder).

Figure 14 shows stroke death rates by age group. In Kentucky, about one out of every eight stroke deaths strikes someone under age 65, a figure comparable with that for the nation. And just as with death from heart disease, premature stroke deaths have a greater impact on male and black residents of the Commonwealth (Table 6).

Nearly 18% of stroke deaths among men occur before age 65, more than twice the rate for women. Black men have the greatest burden, with over one-quarter of all stroke deaths occurring among those younger than 65, a figure about 60% greater than the rate for white men. About 18% of black women die prematurely from stroke, more than twice the figure for white women.

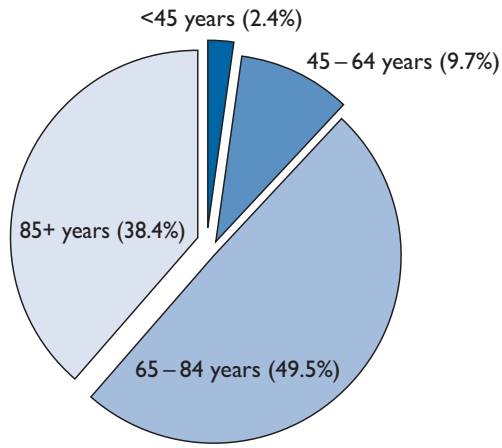


Figure 14. Stroke deaths by age group in Kentucky, 1999–2001 (Source: CDC Wonder).

Map 3 shows stroke death rates by across Kentucky by county. Contrary to what is seen for heart disease, many counties in eastern and southeastern Kentucky have among the lowest stroke death rates in the state. Counties with the highest rates are scattered throughout the state. Appendix C lists stroke death rates for each county in Kentucky.

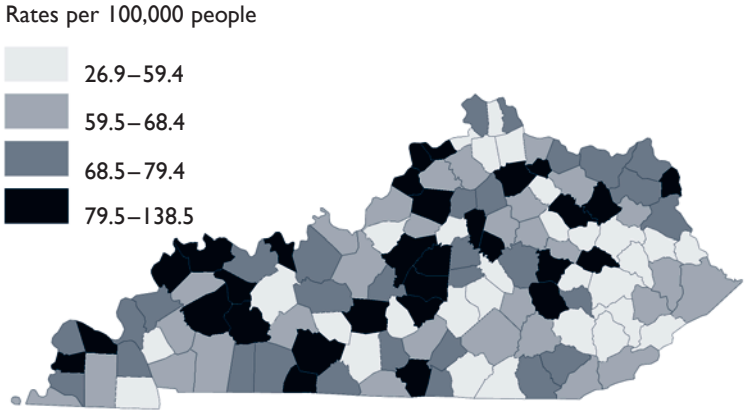
Table 6. Stroke deaths before age 65 in Kentucky, 1999–2001 (Source: CDC Wonder).

Kentucky	12.1%
Males	17.5%
Females	8.8%
White males	16.8%
White females	8.2%
Black males	26.4%
Black females	17.8%

In 2003, about 11,500 hospitalizations were attributable to stroke in Kentucky, accounting for about 2% of all hospitalizations in the state (Table 7). At 5.8 days, the average length of hospitalization for stroke is a full day longer than it is for heart disease. Almost $220

million in hospital charges were billed for stroke in Kentucky during 2003, averaging nearly $19,000 per hospitalization. Of that total, about $140 million (64%) were billed to Medicare, and $13 million (6%) were charged to Medicaid.

Appendix C lists county-specific stroke hospitalization data.



Map 3. Age-adjusted stroke death rates by Kentucky county, 1999–2001 (Source: CDC Wonder). *Counties darkly shaded have the highest mortality rates and those lightly shaded have the lowest rates.*

Table 7. Stroke hospitalizations in Kentucky, 2003 (Source: Health Policy Development Branch, KDPH).

Total hospitalizations	11,538
Average length of hospital stay	5.8 days
Total charges	$217 million
Average charge per hospitalization	$18,845

Risk factors among adults

Risk factors are traits and behaviors that increase the likelihood that a person will develop an illness or condition. Researchers have identified several risk factors for cardiovascular disease (CVD). These risk factors are often divided into two categories — *non-modifiable* risk factors or those that cannot be changed, and *modifiable* risk factors or those that can be changed (Table 8).

Table 8. The major risk factors for cardiovascular disease.

Non-modifiable risk factors	Modifiable risk factors
Increasing age	High blood pressure
Sex	Cigarette smoking
Family history	High blood cholesterol
Race	Overweight and obesity
	Physical inactivity
	Diet low in fruits and vegetables
Diabetes	

The major non-modifiable risk factors for CVD are increasing age, being male, and family history and race.

- **Increasing age** — About four out of five people who die from coronary heart disease are 65 or older. The chance of having a stroke more than doubles for each decade of life after age 55.
- **Sex** — Men have a greater risk of heart attack than women, and they have heart attacks earlier in life. In most age groups, more men than women will have a stroke in a given year.
- **Family history and race** — A family history of heart disease or stroke increases your risk for these diseases. Blacks in America have more severe high blood pressure than whites and a higher risk of heart disease and stroke.

Since nothing can be done about these non-modifiable risk factors it is important to focus on the factors that can be changed, treated, or controlled. Below are the main modifiable risk factors for CVD. Appendix D lists the percentage of adults with each of the following modifiable CVD risk factors for Kentucky's 15 Area Development Districts.

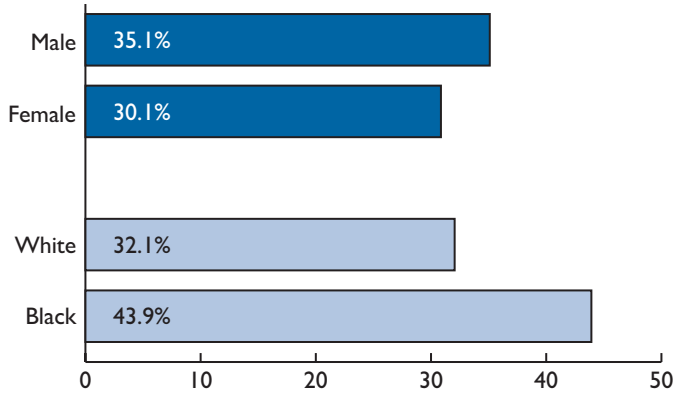


Figure 15. Age-adjusted percentages of adults with high blood pressure by sex and race in Kentucky, 2001 (Source: BRFSS).

- **High blood pressure** — Blood pressure of 140/90 mm Hg or higher is a major risk factor for both heart disease and stroke. In Kentucky, about 33% of adults have been told by

a health professional that their blood pressure is high, compared with 28.5% of adults nationally. Figure 15 shows the percentage of adults in Kentucky who have high blood pressure by sex and race. Slightly more men than women report having high blood pressure. More than 40% of black adults have the condition.

■ **Cigarette smoking** — Smoking, the most preventable cause of death in the U.S., greatly increases the risk of heart disease and stroke. With nearly a third of all adults identifying themselves as current smokers, Kentucky has the highest adult smoking rate in the nation. Nationally, about 22% of adults are current smokers. Figure 16 shows the percentage of adult smokers in Kentucky by sex and race.

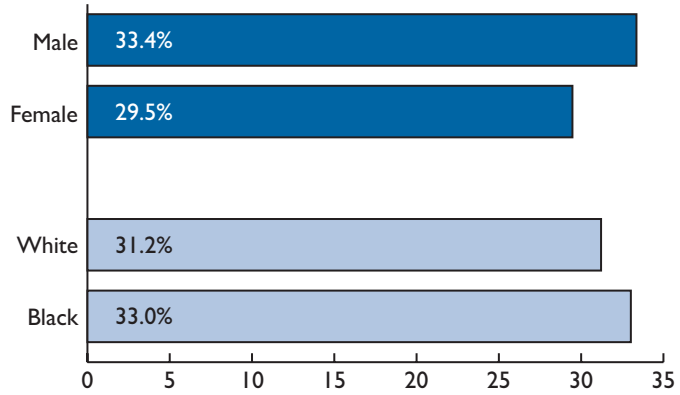


Figure 16. Age-adjusted percentages of adult current smokers by sex and race in Kentucky, 2000–02 (Source: BRFSS).

■ **High cholesterol** — A blood cholesterol level of 240 mg/dL or higher is another major risk factor for heart disease and stroke. In fact, those with high cholesterol have more than twice the risk of heart disease than those whose cholesterol level is below 200. In Kentucky and the U.S., about 25% of adults have ever been told by their doctor that they have high cholesterol, of those who have had their cholesterol checked. Figure 17 shows the percentage of such adults. The percentage for men is about the same as it is for women. But almost twice as many white adults in the state have ever been told by their doctors that they have high cholesterol than black adults.

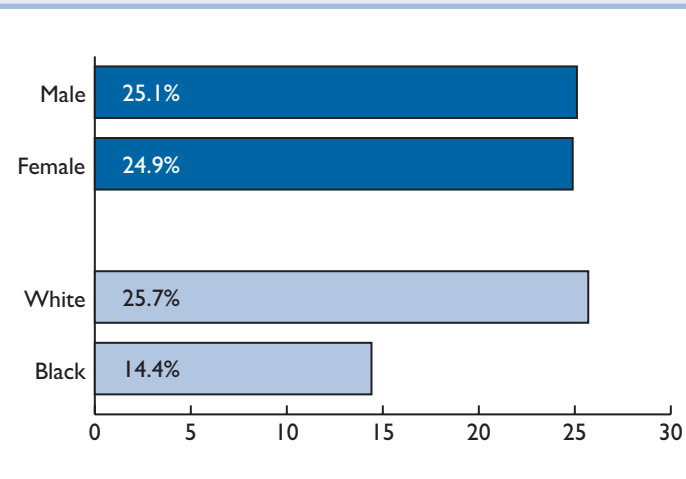


Figure 17. Age-adjusted percentages of adults with high cholesterol by sex and race in Kentucky, 2001 (Source: BRFSS).

■ **Diabetes** — Diabetes is another major risk factor for CVD, and most people with the disease die of some form of heart or blood vessel disease.

Diabetes is considered a partially modifiable risk factor for CVD because it can often be controlled or moderated by changes in behavior. In Kentucky, as well as in the nation, about 7.5% of adults are diabetic. The percentage of men and women in Kentucky with diabetes is almost the same, but the percentage of black adults with the disease is nearly twice as high as it is for white adults (Figure 18).

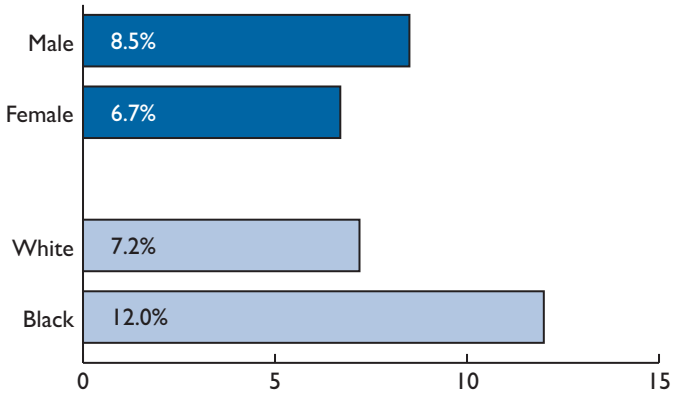


Figure 18. Age-adjusted percentages of adults with diabetes by sex and race in Kentucky, 2000–02 (Source: BRFSS).

■ **Excess weight** — People who are overweight or obese (those with a body mass index, or BMI, of 25 or more) are at increased risk not only for heart disease and stroke, but also for other risk factors associated with CVD. In Kentucky, nearly 63% of adults are overweight or obese, ranking the state sixth highest in the nation. In the U.S., 58% of adults are overweight or obese. Figure 19 shows the rates of adult overweight (BMI = 25.0–29.9) and obesity (BMI = 30.0+) in Kentucky by sex and race. The percentage of men and women who are obese is almost the same, but more men are overweight than women. A different pattern is seen by race: The percentage of white and black adults in Kentucky who are overweight is about the same, but more black adults are obese than white adults.

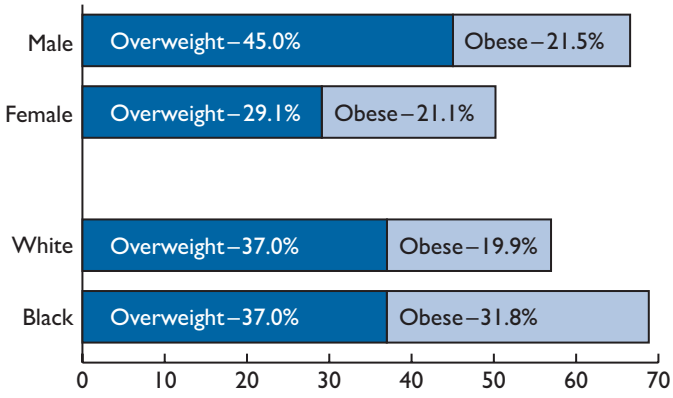


Figure 19. Age-adjusted percentages of overweight and obese adults by sex and race in Kentucky, 2000–02 (Source: BRFSS).

■ **Physical inactivity** — Being physically inactive also increases the risk of heart disease and stroke. Regular physical activity not only reduces the risk of these diseases, but it also helps control diabetes, lower weight, lower blood pressure, as well as control and even lower blood

cholesterol levels — all of which are risk factors for CVD. In Kentucky, over 31% of adults report getting no physical activity, a figure that places the Commonwealth fifth highest among all states in the nation. Nationally, about 27% of adults are physically inactive. Figure 20 shows that among Kentucky adults, more women than men, and more black than white adults are physically inactive.

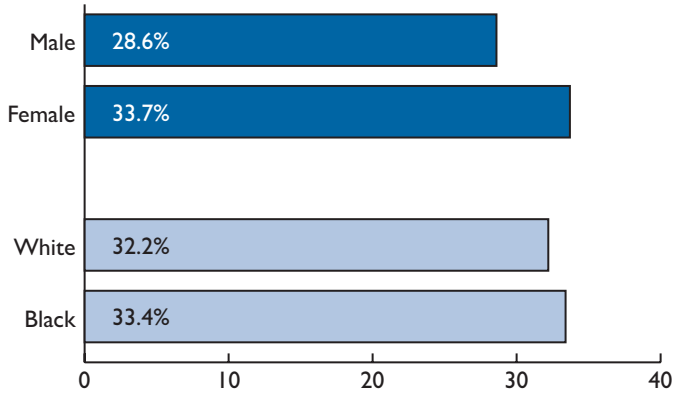


Figure 20. Age-adjusted percentages of adults reporting no leisure time physical activity by sex and race in Kentucky, 2001–02 (Source: BRFSS).

■ **Fewer than five daily servings of fruits and vegetables** — A diet low in fruits and vegetables can also increase the risk for heart disease and stroke. One way to assess the heart healthiness of a diet is to simply count the number of fruit and vegetable servings eaten daily. A minimum of five servings a day of fruits and vegetables has been recommended for better health. In Kentucky, only 22% of adults meet the five-a-day recommendation. Nationally, 25% of adults do. Figure 21 shows the percentage of adults in Kentucky who eat five or more daily servings of fruits and vegetables. More women than men, and more white than black adults meet the five-a-day recommendation.

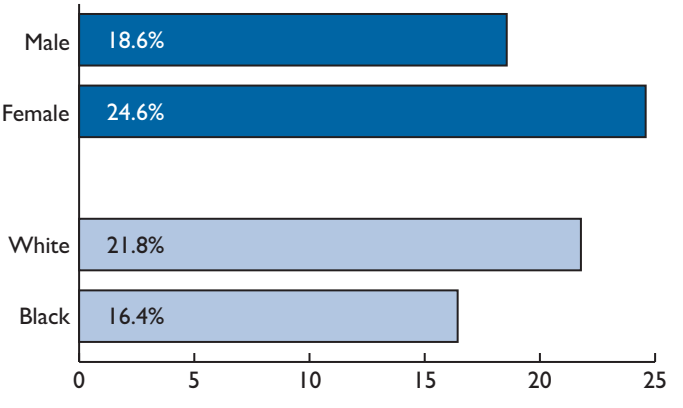


Figure 21. Age-adjusted percentage of adults who eat five or more daily fruit and vegetable servings by sex and race in Kentucky, 2000–02 (Source: BRFSS).

Individuals rarely have just one risk factor for CVD. Often they have several, and these risk factors can reinforce each other such that one can contribute to or cause another. Figure 22 shows the proportion of adults in Kentucky and the U.S. by the number of CVD risk factors they have of the seven modifiable ones listed on pages 13 to 16. In Kentucky, only 3% of adults have none of the noted risk factors for CVD. More than 80% of adults in Kentucky have two or more CVD risk factors, whereas almost 75% do in the U.S. More than 50% of adults in Kentucky have three or more risk factors for CVD, whereas 43% do in the U.S.

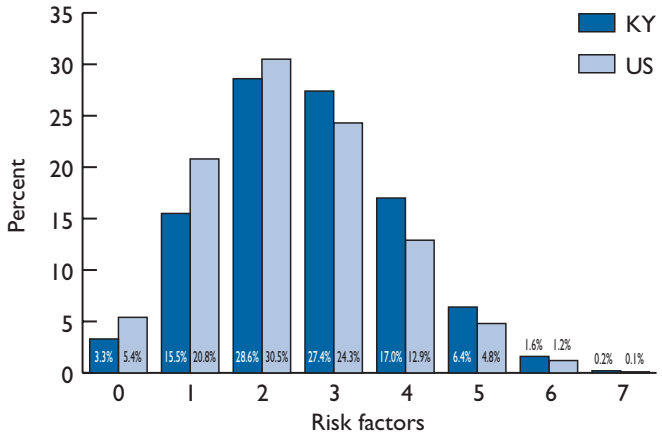


Figure 22. Distribution of the seven major *modifiable* cardiovascular disease risk factors among adults in Kentucky and the U.S., 2000–02 (Source: BRFSS).

Appendix E shows the percentage of adults by number of risk factors for each of Kentucky's 15 Area Development Districts.

Risk factors among children and youth

Even though they are below the age when cardiovascular disease is most likely to strike, children and youth in Kentucky and the nation already have many risk factors for CVD. This trend is troubling because unhealthy habits among adults — such as poor diet, physical inactivity, and tobacco use — often form during childhood and become increasingly difficult to change as people age. Moreover, atherosclerosis, the disease process that causes CVD, begins during childhood. It is vital to instill healthy lifestyle behaviors early on and to help prevent poor ones before they become entrenched later in life.

The struggle Kentucky faces is that children and youth have readily adopted many behaviors that increase their risk. If current trends continue, the Commonwealth may see an adult population in the future that has a greater risk of CVD than previous generations.

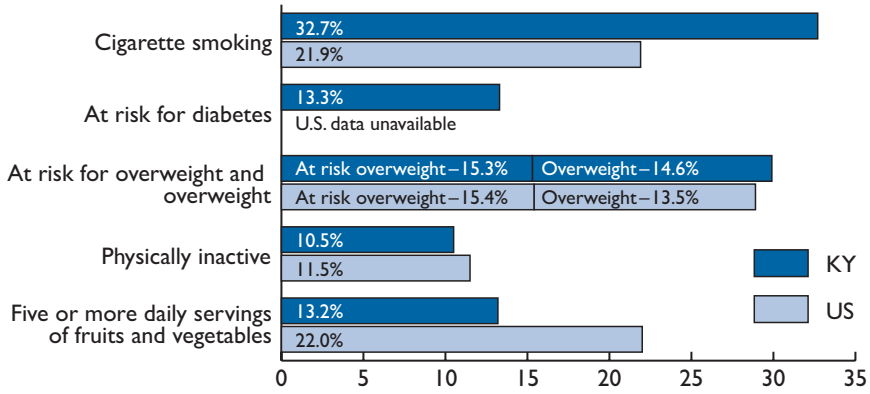


Figure 23. Cardiovascular disease risk factors among high school students in Kentucky and U.S., 2003 (Source: YRBSS).

The major CVD risk factors for youth are described below. Figure 23 compares the percentage of high school students in Kentucky with these CVD risk factors with those in the nation.

■ **Cigarette smoking** — Almost one-third of high school students in Kentucky currently smoke cigarettes, the highest rate in the nation. Nationwide, about 22% of high school students currently smoke.

- 31.8% of Kentucky boys currently smoke
- 33.4% of Kentucky girls currently smoke

■ **At risk for diabetes** — About 13% of high school students in Kentucky have been told by a physician or other health professional that they are at risk of getting diabetes.

- 11.8% of Kentucky boys are at risk of getting diabetes
- 14.9% of Kentucky girls are at risk of getting diabetes

■ **At risk for overweight / overweight** — About 15% of Kentucky high school students are overweight, and another 15% are at risk of becoming overweight. Both percentages are similar to national estimates.

- 19.5% of Kentucky boys are overweight
- 9.5% of Kentucky girls are overweight
- 14.4% of Kentucky boys are at risk of being overweight
- 16.4% of Kentucky girls are at risk of being overweight

■ **Physical inactivity** — Almost 11% of high school students in Kentucky reported no recent moderate or vigorous physical activity, compared with almost 12% of high school students nationwide.

- 7.9% of Kentucky boys reported no recent moderate or vigorous physical activity
- 13.2% of Kentucky girls reported no recent moderate or vigorous physical activity

■ **Fewer than five daily servings of fruits and vegetables** — Only 13% of Kentucky high school students eat five or more daily servings of fruits and vegetables, about half as many as the 22% of high school students that do in the U.S.

- 13.8% of Kentucky boys eat five or more daily servings of fruits and vegetables
- 12.3% of Kentucky girls eat five or more daily servings of fruits and vegetables

Heart attack and stroke warning signs

Every second counts if someone is having a heart attack or stroke. The sooner warning signs and symptoms are recognized and 911 is called, the greater the chance of survival. But not everyone is aware of all the signs and symptoms, or knows what to do in the event of a heart attack and stroke, potentially delaying life-saving treatment. Tables 9 and 10 list the warning signs for heart attack and stroke.

Most adults in Kentucky recognize that pain in the chest, arm, or shoulder, and shortness of breath can be signs of a heart attack (Figure 24). Just over half of adults correctly identify jaw, neck, or back pain as warning signs. And about three-quarters of adults recognize that feeling weak, lightheaded, and faint can be signs. But only 40% of adults in Kentucky were aware of all the warning signs.

Table 9. Heart attack warning signs.
Chest discomfort
Discomfort in other areas of the upper body (arms, back, neck, jaw, stomach)
Shortness of breath
Lightheadedness, nausea, cold sweat

Table 10. Stroke warning signs.
Sudden numbness or weakness of the face, arm, or leg, especially on one side of the body
Sudden confusion, trouble speaking, or understanding
Sudden trouble seeing in one or both eyes
Sudden trouble walking, dizziness, loss of balance or coordination
Sudden, severe headache with no known causes

For stroke, most adults in the state identified sudden numbness or weakness, sudden trouble speaking or confusion, sudden trouble walking, dizziness, and loss of balance as potential warning signs (Figure 25). About 70% of adults attributed sudden vision problems and severe headaches to a possible stroke. Overall, only half of all adults in Kentucky could identify all the warning signs of a stroke.

If a person is showing signs of a heart attack or stroke, the most important thing to do is call 911 immediately for help. Doing so usually is the quickest and most reliable way of

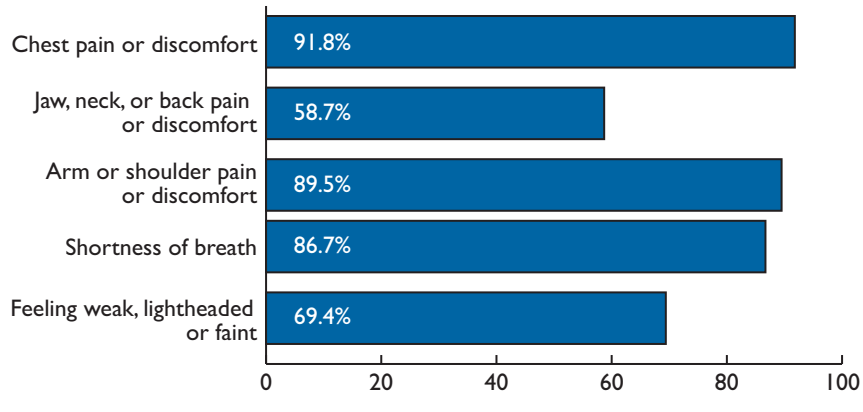


Figure 24. Kentucky adults attributing signs and symptoms to a possible heart attack, 2002 (Source: BRFSS).

getting lifesaving medical attention. Adults in Kentucky were asked how they would respond if they suspected someone was having a heart attack or stroke. Their responses are summarized in Figure 26. Most adults (85%) indicated they would call 911. But only 35% of adults could identify all the signs of a heart attack and would react by calling 911. Only 43% know all the signs for a stroke and would respond by calling 911.

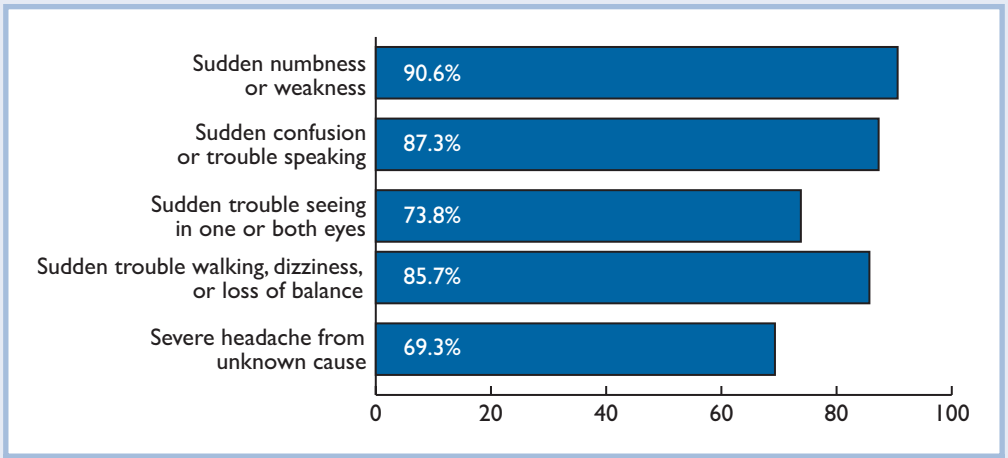


Figure 25. Kentucky adults attributing signs and symptoms to a possible stroke, 2002 (Source: BRFSS).

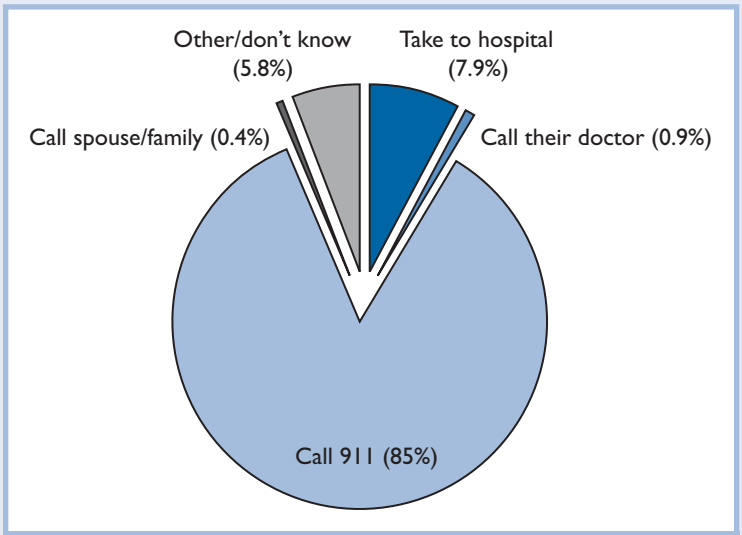


Figure 26. Expected response of Kentucky adults to heart attack or stroke symptoms, 2002 (Source: BRFSS).

Summary

Even though rates have dropped by nearly 35% over the last 25 years, cardiovascular disease (CVD) is by far the leading cause of death in Kentucky. In 2001, more than 15,000 deaths in the Commonwealth were caused by CVD. Of that total, nearly 12,000 deaths were caused by heart disease and more than 2,500 by stroke, the two most common forms of CVD. All told, CVD is responsible for almost four out of every ten deaths in the state.

CVD also exacts an enormous financial toll in the Commonwealth. CVD was responsible for more than 90,000 hospitalizations — almost 16% of all hospital stays in the state — totaling over $2 billion in 2003. Of that amount, $1.3 billion were charged to Medicare and $131 million to Medicaid. The average cost of hospitalization for CVD was $22,500, only slightly less than Kentucky's 1999 per capita income of $23,227. Heart disease hospitalizations averaged nearly $23,000 per stay and stroke hospitalizations almost $19,000 per stay.

Although CVD strikes most often among the elderly, it also kills many adults in their peak earning years. About one out of every five CVD deaths in Kentucky occurs among those younger than 65, cutting productive lives short. These premature deaths are not distributed equally among Kentuckians. Among men in the state, one quarter of CVD deaths are premature. Among women, 11% of CVD deaths are. The percentage of premature deaths among black men in Kentucky is nearly 30% higher than among white men. And among black women, the percentage is almost 50% higher than among white women.

CVD death rates vary across Kentucky counties with no apparent clustering of elevated rates in any one region of the state. But high death rates from heart disease tend to be found in eastern Kentucky and along the Kentucky–Tennessee border. Whether by sex, race, or region, much work needs to be done to reduce CVD disparities across the Commonwealth.

Many of the risk factors for heart disease and stroke are within our control. The challenge the Commonwealth faces is that Kentuckians have all too readily adopted three of the strongest risk factors for CVD — Kentucky adults have the highest smoking rate in the nation, the sixth highest rate of excess weight, and the fifth highest rate of physical inactivity. Our children and youth have also adopted many behaviors that place them at higher risk for CVD.

Kentuckians need to recognize the signs of heart attack and stroke and know what to do in their event. Only about a third of Kentucky adults can identify all the signs of a heart attack and would respond by calling 911. And only slightly more than four out of ten Kentuckians know all the signs of a stroke and would respond appropriately.

Reducing Kentucky's CVD burden will be a massive undertaking. We need to foster partnerships not only between public and private organizations but also between professionals and volunteers. A major objective of this report is to help coordinate these alliances by providing a common understanding of the CVD burden in the Commonwealth.

Glossary

Atherosclerosis — Atherosclerosis is a disease process in which deposits of fatty substances, cholesterol, cellular waste products, calcium, and other substances build up in the inner lining of arteries. This build-up is called plaque.

Plaques can grow large enough to substantially reduce blood flow through an artery. But most of the damage occurs when they become fragile and rupture. Plaques that rupture cause blood clots that can block the flow of blood. Plaques can also break off and travel to another part of the body. If either happens and blocks a blood vessel that feeds the heart, it causes a heart attack. If it blocks a blood vessel that feeds the brain, it causes a stroke.

From the American Heart Association — http://www.americanheart.org/presenter.jhtml?identifier=4440

Cardiovascular disease — Cardiovascular disease is a broad, all-encompassing term. Cardiovascular disease refers to any disorder in any of the various parts of the cardiovascular system. Cardiovascular disease has two main components: diseases of the heart and diseases of the blood vessels.

From the Mayo Clinic — http://www.mayoclinic.com/invoke.cfm?id=HB00032

Coronary heart disease — Coronary heart disease is a narrowing of the blood vessels that supply blood and oxygen to the heart. Coronary heart disease usually results from the build-up of fatty material and plaque. As the coronary arteries narrow, the flow of blood to the heart can slow or stop. The disease can cause chest pain, shortness of breath, heart attack, or other symptoms.

From MedlinePlus Medical Encyclopedia — http://www.nlm.nih.gov/medlineplus/ency/article/007115.htm

Heart disease — Heart disease is any disorder that affects the heart's ability to function normally. The most common cause of heart disease is narrowing or blockage of the coronary arteries, which supply blood to the heart itself.

From MedlinePlus Medical Encyclopedia — http://www.nlm.nih.gov/medlineplus/ency/article/000147.htm

Stroke — Stroke is a type of cardiovascular disease. It affects the blood vessels that supply blood to the brain. A stroke occurs when a blood vessel that brings oxygen and nutrients to the brain bursts or is clogged by a blood clot or other mass. Because of this rupture or blockage, part of the brain is robbed of blood. Deprived of oxygen, nerve cells in the affected area of the brain can't work and die within minutes. And when nerve cells can't work, the part of the body they control can't work either. The devastating effects of a severe stroke are often permanent because dead brain cells aren't replaced.

From the American Heart Association — http://www.americanheart.org/presenter.jhtml?identifier=4755

Heart attack — A heart attack, or myocardial infarction, occurs when an area of heart muscle dies or is permanently damaged because of an inadequate supply of oxygen to that area.

Most heart attacks are caused by a clot that blocks one of the coronary arteries, the blood vessels that bring blood and oxygen to the heart muscle. The clot usually forms in a coronary artery that has been previously narrowed because of atherosclerosis. The atherosclerotic plaque inside the arterial wall sometimes cracks, and this triggers the formation of a clot. A clot in the coronary artery interrupts the flow of blood and oxygen to the heart muscle, leading to the death of heart cells in that area. The damaged heart muscle loses its ability to contract, and the remaining heart muscle needs to compensate for that weakened area.

From MedlinePlus Medical Encyclopedia — http://www.nlm.nih.gov/medlineplus/ency/article/000195.htm

Age-adjusted rates — Researchers adjust rates for age because many diseases, such as cardiovascular disease and cancer, occur more frequently in the old than in the young, and different populations may have different age compositions. Florida, for example, has an older average population age than the nation as a whole because Florida tends to attract retirees. Alaska, on the other hand, has a younger population age than average because it tends to attract young people eager for adventure. Adjustment for such differences in age compositions allows researchers to make valid comparisons of rates across different regions, populations, and periods.

Mortality rate (*also* death rate) — The mortality rate is a measure of the proportion of deaths that occur because of a particular cause in a given population during a specified time. Mortality rates are often reported per 100,000 people.

Premature death — Premature death has both a statistical and actuarial meaning. A premature death is one that occurs before statistical expectation, usually because of a specific cause. The term also refers to the death of a person while that person's family relies on his or her earnings for support. In this report, premature death means one that not only has occurred earlier than expected, but also one that has occurred before age 65.

Technical notes

Data sources

Risk factor and warning signs estimates for adults come from the Behavioral Risk Factor Surveillance System (BRFSS), courtesy of the Kentucky Department for Public Health and the CDC. The BRFSS is an annual telephone survey that assesses health behaviors and disease prevention practices among adults 18 years of age and older. BRFSS data used in this report are from the 2000–02 surveys combined and are age-adjusted to the 2002 BRFSS. Data presented by race (*i.e.*, white and black) include only non-Hispanic ethnicities. Other race and ethnic groups were not reported because of small sample sizes.

Risk factor data for youth were obtained from the 2003 Youth Risk Behavior Surveillance System (YRBSS), courtesy of the Kentucky Department of Education, University of Kentucky Center for Prevention Research, and the CDC. The YRBSS, conducted every two years, surveys high school students in grades 9 to 12 to monitor priority health risk behaviors among youth.

Mortality data come from CDC Wonder, a Web-based health data repository maintained by CDC. Rates are age-adjusted to the 2000 U.S. standard population. For trends data, NCHS comparability ratios were used to compensate for differences in mortality classification between ICD-9 and ICD-10. These ratios were applied to 1999, 2000, and 2001 death rates to make them comparable with rates from 1979 to 1998. The table below lists the ICD codes used to classify deaths in this report.

Disease	ICD-9	ICD-10
Cardiovascular disease	390–434, 436–448	I00–I99
Heart disease	390–398, 402, 404, 410–429	I00–I09, I11, I13, I20–I51
Stroke	430–434, 436–438	I60–I69

Kentucky inpatient hospitalization claims data (2003) were provided by the Kentucky Department for Public Health, Health Policy Branch. Individual Kentucky resident inpatient claims were extracted using primary ICD-9 diagnosis codes (see table above).

Maps

Maps were created using Environmental Systems Research Institute's (ESRI) ArcView GIS 3.2 software. All maps were projected using the 1983 State Plane coordinate system. County-level death rates were grouped into quartiles.

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Appendix A: Cardiovascular disease

County	Age-adjusted death rate (1999–2000)	Number of hospitalizations	Average length of hospital stay (days)	Average charge per hospitalization	Total charges billed
KENTUCKY	392.2	92,089	4.8	$22,486.64	$2,070,771,746
Adair	349.4	550	5.0	$20,757.39	$11,416,565
Allen	409.4	436	4.4	$18,956.45	$8,265,012
Anderson	337.6	390	4.8	$27,067.27	$10,556,234
Ballard	588.6	174	4.7	$23,460.86	$4,082,190
Barren	353.3	1,150	4.3	$16,044.67	$18,451,371
Bath	377.2	300	4.0	$17,760.80	$5,328,240
Bell	456.0	1,024	4.7	$12,557.61	$12,858,996
Boone	347.3	1,449	5.2	$26,111.02	$37,834,875
Bourbon	390.0	404	4.1	$20,077.17	$8,111,176
Boyd	400.3	1,445	4.7	$20,819.15	$30,083,665
Boyle	367.7	610	5.4	$24,642.36	$15,031,841
Bracken	484.2	187	3.6	$17,099.21	$3,197,552
Breathitt	539.7	530	3.7	$20,422.59	$10,823,974
Breckinridge	422.7	406	5.4	$25,379.37	$10,304,025
Bullitt	396.5	955	5.4	$32,872.10	$31,392,852
Butler	412.9	290	5.0	$20,988.09	$6,086,545
Caldwell	393.9	292	4.1	$15,733.60	$4,594,210
Calloway	350.0	748	5.2	$18,625.35	$13,931,762
Campbell	373.9	1,764	4.8	$23,357.42	$41,202,489
Carlisle	498.6	178	4.8	$19,758.63	$3,517,037
Carroll	469.2	286	4.8	$28,479.59	$8,145,164
Carter	425.5	663	4.6	$20,505.16	$13,594,923
Casey	383.1	463	4.4	$19,871.72	$9,200,606
Christian	425.6	758	4.9	$11,997.12	$9,093,816
Clark	354.6	713	4.2	$21,601.45	$15,401,832
Clay	412.1	1,151	4.1	$19,329.50	$22,248,252
Clinton	402.1	482	4.3	$12,405.61	$5,979,503
Crittenden	559.1	368	3.6	$11,317.48	$4,164,834
Cumberland	570.2	223	4.5	$15,712.60	$3,503,909
Daviess	338.9	2,130	4.7	$19,236.50	$40,973,740
Edmonson	262.5	237	5.2	$21,341.62	$5,057,964
Elliott	312.6	90	4.9	$20,147.67	$1,813,290
Estill	438.2	345	4.3	$21,099.59	$7,279,359
Fayette	343.3	3,611	5.3	$23,745.26	$85,744,135
Fleming	403.2	427	4.3	$17,146.91	$7,321,731
Floyd	412.4	1,323	4.3	$18,966.56	$25,092,761
Franklin	361.9	1,230	4.5	$25,060.30	$30,824,168
Fulton	433.3	187	4.2	$17,960.65	$3,358,641
Gallatin	442.3	160	4.8	$25,499.96	$4,079,993
Garrard	311.4	275	4.9	$24,305.00	$6,683,874
Grant	340.3	511	4.6	$25,991.97	$13,281,897
Graves	381.8	1,048	4.7	$17,988.73	$18,852,186
Grayson	439.3	635	4.9	$19,972.23	$12,682,367
Green	305.9	304	5.9	$22,233.27	$6,758,915
Greenup	402.2	1,050	4.6	$19,826.53	$20,817,855
Hancock	425.2	158	4.3	$17,355.88	$2,742,229
Hardin	355.6	1,620	6.2	$21,193.84	$34,334,026
Harlan	429.5	1,201	3.6	$17,703.15	$21,261,479
Harrison	469.9	393	4.4	$17,523.05	$6,886,557
Hart	447.4	484	4.3	$16,416.05	$7,945,370
Henderson	435.9	798	4.8	$14,894.69	$11,885,965
Henry	407.2	428	5.3	$23,948.05	$10,249,767
Hickman	359.6	113	4.2	$16,973.12	$1,917,962
Hopkins	394.0	1,164	4.4	$17,714.94	$20,620,190
Jackson	437.7	358	4.7	$23,030.72	$8,244,997
Jefferson	374.2	15,876	5.5	$29,252.84	$464,418,077
Jessamine	339.6	559	4.7	$23,191.61	$12,964,111
Johnson	399.2	775	4.4	$24,283.39	$18,819,625
Kenton	339.7	2,641	5.3	$26,783.07	$70,734,091
Knott	455.4	581	4.5	$20,206.50	$11,739,976

County	Age-adjusted death rate (1999–2000)	Number of hospitalizations	Average length of hospital stay (days)	Average charge per hospitalization	Total charges billed
KENTUCKY	392.2	92,089	4.8	$22,486.64	$2,070,771,746
Knox	439.7	907	4.0	$17,060.07	$15,473,481
Larue	345.4	260	6.7	$20,416.74	$5,308,352
Laurel	435.9	1,561	4.6	$23,335.30	$36,426,411
Lawrence	471.1	669	3.5	$17,045.23	$11,403,262
Lee	387.3	246	3.6	$20,865.05	$5,132,802
Leslie	370.7	514	4.2	$16,411.07	$8,435,288
Letcher	438.1	1,001	4.1	$17,192.04	$17,209,234
Lewis	430.4	293	3.8	$19,464.11	$5,702,983
Lincoln	382.7	618	4.5	$19,068.68	$11,784,442
Livingston	472.5	353	4.2	$18,884.28	$6,666,152
Logan	441.5	662	4.2	$15,877.87	$10,511,149
Lyon	379.0	165	4.2	$21,049.33	$3,473,140
Madison	449.2	953	4.8	$21,282.65	$20,282,362
Magoffin	376.5	384	3.9	$19,873.54	$7,631,440
Marion	479.9	360	4.6	$27,031.23	$9,731,244
Marshall	391.1	823	4.5	$20,829.70	$17,142,843
Martin	410.9	400	3.9	$18,740.73	$7,496,291
Mason	354.9	473	3.2	$14,820.50	$7,010,097
McCracken	402.5	1,807	5.2	$21,547.89	$38,937,032
McCreary	549.6	287	4.6	$27,765.71	$7,968,759
McLean	462.4	247	4.9	$20,672.34	$5,106,069
Meade	393.0	356	6.1	$30,037.98	$10,693,520
Menifee	387.1	141	4.4	$22,256.74	$3,138,201
Mercer	367.8	486	4.6	$22,241.24	$10,809,243
Metcalfe	417.9	308	4.4	$16,738.10	$5,155,336
Monroe	430.5	456	4.6	$16,934.05	$7,721,928
Montgomery	381.4	445	4.0	$20,384.43	$9,071,073
Morgan	320.6	328	4.6	$20,862.77	$6,842,987
Muhlenberg	441.8	690	3.9	$14,824.62	$10,228,986
Nelson	357.7	583	5.1	$28,154.85	$16,414,276
Nicholas	278.5	175	4.2	$19,997.79	$3,499,613
Ohio	387.6	526	4.2	$18,702.64	$9,837,590
Oldham	358.8	719	4.6	$23,000.93	$16,537,672
Owen	384.8	146	4.7	$30,778.86	$4,493,714
Owsley	421.8	220	4.0	$19,735.46	$4,341,801
Pendleton	437.3	337	4.9	$25,958.85	$8,748,131
Perry	511.3	1,312	5.1	$21,208.21	$27,825,175
Pike	524.2	1,901	5.2	$22,924.08	$43,578,671
Powell	450.2	262	4.5	$23,060.32	$6,041,804
Pulaski	377.4	1,546	4.6	$27,674.49	$42,784,762
Robertson	496.8	55	3.3	$17,516.16	$963,389
Rockcastle	374.7	395	3.6	$15,997.87	$6,319,158
Rowan	381.1	481	4.4	$18,472.33	$8,885,190
Russell	405.7	531	4.6	$19,718.48	$10,470,515
Scott	381.7	453	3.9	$20,317.79	$9,203,957
Shelby	483.0	518	5.0	$26,567.65	$13,762,042
Simpson	470.3	297	5.1	$14,975.72	$4,447,788
Spencer	445.0	192	4.6	$24,298.07	$4,665,230
Taylor	377.1	704	5.4	$24,012.92	$16,905,097
Todd	472.7	146	4.1	$12,087.72	$1,764,807
Trigg	426.2	219	4.9	$16,306.72	$3,571,171
Trimble	368.6	160	4.7	$24,103.23	$3,856,516
Union	466.5	235	3.9	$11,918.39	$2,800,821
Warren	397.4	1,769	5.6	$22,276.39	$39,406,942
Washington	335.0	220	4.6	$25,328.02	$5,572,164
Wayne	373.1	406	4.4	$24,722.08	$10,037,164
Webster	316.8	275	4.8	$18,759.44	$5,158,846
Whitley	466.1	1,368	4.6	$19,871.96	$27,184,840
Wolfe	497.7	295	3.8	$21,900.20	$6,460,559
Woodford	397.7	349	4.5	$25,637.50	$8,947,486

Appendix B: Heart disease

County	Age-adjusted death rate (1999–2000)	Number of hospitalizations	Average length of hospital stay (days)	Average charge per hospitalization	Total charges billed
KENTUCKY	302.8	73,325	4.6	$22,917.85	$1,680,451,267
Adair	263.6	449	4.9	$21,832.56	$9,802,820
Allen	321.6	330	4.3	$18,783.31	$6,198,492
Anderson	258.9	314	4.7	$28,331.79	$8,896,183
Ballard	487.5	133	4.6	$25,500.08	$3,391,511
Barren	284.3	927	3.9	$15,757.64	$14,607,333
Bath	279.6	251	3.8	$18,862.14	$4,734,396
Bell	369.8	822	4.6	$13,051.98	$10,728,731
Boone	257.3	1,165	4.8	$26,489.81	$30,860,627
Bourbon	286.3	352	3.8	$20,226.38	$7,119,686
Boyd	285.6	1,149	4.7	$21,259.81	$24,427,525
Boyle	267.6	489	5.1	$25,260.86	$12,352,562
Bracken	384.5	147	3.4	$17,823.96	$2,620,122
Breathitt	487.1	420	3.6	$20,698.83	$8,693,507
Breckinridge	324.8	327	5.2	$26,488.12	$8,661,615
Bullitt	318.9	757	5.2	$34,350.75	$26,003,517
Butler	321.3	195	4.8	$21,134.02	$4,121,134
Caldwell	311.6	219	3.9	$16,023.78	$3,509,208
Calloway	286.5	572	4.7	$18,384.67	$10,516,030
Campbell	271.7	1,432	4.5	$23,581.71	$33,769,007
Carlisle	350.5	129	4.6	$20,520.19	$2,647,105
Carroll	361.4	246	4.4	$27,898.85	$6,863,117
Carter	330.1	544	4.3	$20,037.30	$10,900,289
Casey	300.0	407	4.1	$19,512.54	$7,941,602
Christian	334.9	538	4.8	$11,714.43	$6,302,364
Clark	275.1	584	4.1	$22,523.12	$13,153,504
Clay	342.5	1,010	4.0	$19,491.27	$19,686,185
Clinton	294.0	394	4.2	$12,474.19	$4,914,832
Crittenden	470.0	271	3.5	$12,036.56	$3,261,908
Cumberland	470.4	156	4.6	$18,434.75	$2,875,821
Daviess	248.4	1,657	4.6	$19,725.88	$32,685,791
Edmonson	191.1	166	5.4	$22,914.40	$3,803,790
Elliott	233.5	70	4.3	$20,826.84	$1,457,879
Estill	349.6	280	4.0	$21,306.22	$5,965,742
Fayette	257.5	2,861	4.8	$23,966.68	$68,568,683
Fleming	323.9	341	3.9	$17,092.67	$5,828,601
Floyd	324.9	1,099	4.1	$19,409.95	$21,331,535
Franklin	265.3	1,004	4.3	$25,654.69	$25,757,308
Fulton	348.4	145	4.2	$18,417.15	$2,670,487
Gallatin	363.3	129	4.5	$26,520.42	$3,421,134
Garrard	238.0	223	4.6	$24,610.26	$5,488,087
Grant	285.5	394	4.1	$26,112.89	$10,288,480
Graves	289.7	783	4.4	$17,340.02	$13,577,236
Grayson	346.5	502	4.2	$18,903.72	$9,489,667
Green	245.7	231	5.3	$21,755.65	$5,025,555
Greenup	307.4	862	4.5	$20,279.48	$17,480,914
Hancock	323.3	116	4.4	$18,678.71	$2,166,730
Hardin	268.0	1,152	5.9	$21,838.91	$25,158,426
Harlan	332.2	1,051	3.4	$17,695.06	$18,597,508
Harrison	354.9	326	4.1	$17,674.89	$5,762,015
Hart	337.6	393	4.0	$16,654.57	$6,545,247
Henderson	338.2	608	4.8	$14,639.78	$8,900,984
Henry	318.9	343	5.0	$23,271.05	$7,981,970
Hickman	263.6	91	4.4	$18,529.13	$1,686,151
Hopkins	296.9	953	4.2	$17,784.82	$16,948,930
Jackson	339.3	293	4.6	$23,733.34	$6,953,869
Jefferson	290.9	12,368	5.3	$29,846.37	$369,139,920
Jessamine	239.3	448	4.4	$23,826.81	$10,674,412
Johnson	323.0	638	4.3	$23,951.55	$15,281,092
Kenton	260.6	2,027	5.0	$28,068.29	$56,894,418
Knott	375.3	487	4.4	$20,531.38	$9,998,782

County	Age-adjusted death rate (1999–2000)	Number of hospitalizations	Average length of hospital stay (days)	Average charge per hospitalization	Total charges billed
KENTUCKY	302.8	73,325	4.6	$22,917.85	$1,680,451,267
Knox	341.3	761	3.8	$17,567.10	$13,368,565
Larue	244.6	181	5.4	$17,496.27	$3,166,824
Laurel	349.5	1,337	4.5	$23,710.45	$31,700,865
Lawrence	381.7	583	3.5	$17,430.37	$10,161,905
Lee	322.0	204	3.4	$21,715.40	$4,429,941
Leslie	294.3	416	4.2	$16,724.22	$6,957,276
Letcher	362.4	835	4.0	$17,641.18	$14,730,387
Lewis	324.8	230	3.4	$20,100.78	$4,623,180
Lincoln	321.4	504	4.2	$18,566.26	$9,357,393
Livingston	381.8	243	4.4	$22,021.59	$5,351,247
Logan	361.9	525	4.0	$14,776.03	$7,757,415
Lyon	316.6	126	4.2	$22,817.94	$2,875,060
Madison	337.8	756	4.3	$21,185.74	$16,016,423
Magoffin	289.4	318	3.7	$20,102.21	$6,392,504
Marion	352.0	291	4.5	$29,159.67	$8,485,465
Marshall	306.1	620	4.5	$21,915.96	$13,587,895
Martin	322.8	343	3.7	$18,980.57	$6,510,337
Mason	260.3	392	2.9	$15,690.78	$6,150,784
McCracken	292.5	1,321	5.1	$22,343.65	$29,515,968
McCreary	486.4	222	4.1	$26,757.53	$5,940,172
McLean	339.4	186	4.6	$21,432.86	$3,986,512
Meade	293.4	269	5.8	$30,622.12	$8,237,350
Menifee	324.6	115	4.2	$23,129.30	$2,659,869
Mercer	272.1	398	4.2	$22,847.16	$9,093,168
Metcalfe	334.4	240	4.0	$17,144.89	$4,114,774
Monroe	352.2	387	4.7	$17,948.30	$6,945,993
Montgomery	306.7	365	3.8	$20,764.22	$7,578,941
Morgan	267.9	276	4.3	$22,003.46	$6,072,954
Muhlenberg	330.2	514	3.9	$15,389.39	$7,910,144
Nelson	249.1	461	4.9	$29,756.24	$13,717,628
Nicholas	216.7	150	4.1	$21,402.11	$3,210,316
Ohio	330.8	403	4.2	$19,434.03	$7,831,913
Oldham	244.5	596	4.5	$23,698.81	$14,124,493
Owen	298.7	122	4.5	$31,491.30	$3,841,938
Owsley	343.1	186	3.7	$18,980.84	$3,530,436
Pendleton	354.1	280	4.4	$26,320.88	$7,369,846
Perry	474.7	1,112	5.1	$21,509.03	$23,918,042
Pike	438.7	1,572	5.2	$23,884.69	$37,546,725
Powell	353.0	208	4.4	$24,830.98	$5,164,844
Pulaski	297.3	1,274	4.4	$28,326.30	$36,087,702
Robertson	372.0	46	3.2	$19,204.96	$883,428
Rockcastle	282.9	321	3.3	$16,218.87	$5,206,257
Rowan	261.2	431	3.9	$17,869.10	$7,701,582
Russell	308.3	405	4.2	$19,616.86	$7,944,828
Scott	290.1	355	3.8	$21,444.74	$7,612,882
Shelby	340.7	435	4.8	$26,253.20	$11,420,140
Simpson	361.2	227	4.7	$14,217.61	$3,227,397
Spencer	357.4	163	4.6	$24,860.83	$4,052,316
Taylor	259.5	561	5.1	$24,982.53	$14,015,202
Todd	382.2	108	3.8	$11,442.09	$1,235,746
Trigg	342.7	161	3.9	$14,543.46	$2,341,497
Trimble	260.4	137	4.6	$24,360.91	$3,337,444
Union	352.7	182	3.9	$12,509.80	$2,276,783
Warren	295.3	1,340	5.7	$23,081.79	$30,929,592
Washington	229.7	168	4.4	$25,746.74	$4,325,453
Wayne	305.8	330	4.5	$25,888.16	$8,543,094
Webster	242.5	207	4.6	$18,409.11	$3,810,685
Whitley	355.6	1,132	4.5	$20,822.47	$23,571,037
Wolfe	395.0	244	3.6	$22,704.80	$5,539,970
Woodford	271.9	280	4.1	$26,288.09	$7,360,664

Appendix C: Stroke

County	Age-adjusted death rate (1999–2000)	Number of hospitalizations	Average length of hospital stay (days)	Average charge per hospitalization	Total charges billed
KENTUCKY	67.5	11,538	5.8	$18,845.43	$217,438,585
Adair	63.4	67	6.1	$15,223.25	$1,019,958
Allen	75.5	58	5.4	$18,863.71	$1,094,095
Anderson	55.5	46	5.8	$19,599.13	$901,560
Ballard	79.3	28	4.7	$11,816.75	$330,869
Barren	54.4	131	6.2	$17,593.85	$2,304,795
Bath	79.8	38	5.3	$12,650.00	$480,700
Bell	59.7	121	5.6	$11,607.31	$1,404,484
Boone	69.9	189	6.9	$21,927.38	$4,144,275
Bourbon	65.0	28	6.1	$16,991.75	$475,769
Boyd	88.5	189	4.8	$14,484.16	$2,737,506
Boyle	76.2	72	6.8	$21,157.06	$1,523,308
Bracken	68.4	28	4.4	$12,127.29	$339,564
Breathitt	41.9	62	4.3	$21,609.89	$1,339,813
Breckinridge	78.0	54	6.2	$20,735.78	$1,119,732
Bullitt	58.8	133	6.2	$24,535.92	$3,263,278
Butler	66.8	57	5.0	$19,277.09	$1,098,794
Caldwell	66.8	53	4.2	$10,316.40	$546,769
Calloway	53.0	102	6.1	$15,467.53	$1,577,688
Campbell	78.5	199	6.1	$17,197.84	$3,422,370
Carlisle	138.5	31	5.4	$13,363.71	$414,275
Carroll	93.9	26	4.5	$15,013.31	$390,346
Carter	77.3	80	6.4	$18,769.38	$1,501,550
Casey	58.9	32	6.5	$17,692.47	$566,159
Christian	68.1	141	5.4	$12,922.09	$1,822,015
Clark	61.0	88	4.8	$13,800.75	$1,214,466
Clay	56.4	80	5.0	$17,158.50	$1,372,680
Clinton	75.0	39	5.4	$17,781.26	$693,469
Crittenden	72.4	66	3.6	$7,384.27	$487,362
Cumberland	89.9	38	4.3	$10,308.37	$391,718
Daviess	70.4	289	4.6	$12,700.97	$3,670,579
Edmonson	52.9	39	4.2	$14,440.59	$563,183
Elliott	60.0	17	7.4	$18,355.88	$312,050
Estill	84.5	44	5.1	$16,394.27	$721,348
Fayette	64.1	452	7.1	$21,438.57	$9,690,235
Fleming	65.6	62	6.5	$14,698.40	$911,301
Floyd	63.5	127	5.4	$15,960.18	$2,026,943
Franklin	72.0	136	5.6	$21,132.86	$2,874,069
Fulton	63.1	26	4.8	$13,974.35	$363,333
Gallatin	59.4	19	7.4	$19,167.11	$364,175
Garrard	55.0	34	6.5	$25,258.09	$858,775
Grant	36.3	78	6.1	$18,813.82	$1,467,478
Graves	67.6	175	5.5	$17,775.71	$3,110,749
Grayson	75.1	92	8.1	$19,335.91	$1,778,904
Green	44.8	47	8.9	$23,926.53	$1,124,547
Greenup	79.4	107	5.6	$17,422.04	$1,864,158
Hancock	82.3	22	4.0	$9,789.00	$215,358
Hardin	61.4	329	7.0	$16,412.66	$5,399,765
Harlan	64.7	88	4.6	$13,864.60	$1,220,085
Harrison	80.9	51	5.4	$13,997.20	$713,857
Hart	88.9	57	5.7	$12,877.60	$734,023
Henderson	82.8	116	5.3	$16,520.84	$1,916,417
Henry	66.8	50	6.4	$22,254.14	$1,112,707
Hickman	76.4	14	3.3	$9,114.43	$127,602
Hopkins	80.5	122	4.9	$14,532.98	$1,773,024
Jackson	88.8	38	6.4	$21,110.37	$802,194
Jefferson	60.7	2,178	6.3	$25,242.76	$54,978,721
Jessamine	85.2	76	6.1	$19,704.45	$1,497,538
Johnson	49.1	74	5.4	$24,773.01	$1,833,203
Kenton	57.0	394	6.8	$20,701.78	$8,156,500
Knott	66.0	59	4.9	$16,676.20	$983,896

County	Age-adjusted death rate (1999–2000)	Number of hospitalizations	Average length of hospital stay (days)	Average charge per hospitalization	Total charges billed
KENTUCKY	67.5	11,538	5.8	$18,845.43	$217,438,585
Knox	73.0	78	5.9	$15,033.00	$1,172,574
Larue	72.6	61	10.0	$27,607.13	$1,684,035
Laurel	64.8	112	6.4	$21,674.39	$2,427,532
Lawrence	69.8	27	6.7	$19,042.11	$514,137
Lee	53.4	22	4.4	$16,107.82	$354,372
Leslie	49.3	50	4.3	$14,338.92	$716,946
Letcher	50.2	81	5.1	$17,238.10	$1,396,286
Lewis	71.8	40	5.4	$16,037.93	$641,517
Lincoln	45.6	65	5.4	$19,684.42	$1,279,487
Livingston	75.4	79	3.8	$11,407.14	$901,164
Logan	69.4	78	4.4	$12,829.79	$1,000,724
Lyon	40.1	23	4.0	$11,042.65	$253,981
Madison	73.8	125	7.0	$18,528.30	$2,316,038
Magoffin	58.0	33	4.7	$21,739.24	$717,395
Marion	102.1	44	4.8	$18,320.68	$806,110
Marshall	69.8	132	4.8	$12,601.37	$1,663,381
Martin	56.9	30	5.1	$18,355.87	$550,676
Mason	77.5	59	5.1	$12,258.15	$723,231
McCracken	84.1	291	5.8	$15,900.46	$4,627,035
McCreary	50.3	29	7.1	$31,074.72	$901,167
McLean	85.4	28	5.2	$11,819.39	$330,943
Meade	68.1	57	7.6	$25,322.95	$1,443,408
Menifee	40.9	16	5.9	$22,029.63	$352,474
Mercer	71.5	55	5.7	$15,754.11	$866,476
Metcalfe	68.9	34	5.4	$13,726.09	$466,687
Monroe	67.1	39	5.0	$12,272.38	$478,623
Montgomery	55.8	48	5.3	$17,089.79	$820,310
Morgan	35.4	38	5.9	$13,618.53	$517,504
Muhlenberg	82.2	125	3.6	$9,711.98	$1,213,998
Nelson	85.2	79	5.7	$17,057.35	$1,347,531
Nicholas	54.2	15	5.6	$12,608.87	$189,133
Ohio	36.5	75	3.9	$11,571.72	$867,879
Oldham	83.5	74	4.8	$16,053.11	$1,187,930
Owen	63.4	9	6.6	$26,843.22	$241,589
Owsley	78.7	20	5.7	$29,117.45	$582,349
Pendleton	58.7	35	7.6	$20,131.20	$704,592
Perry	26.9	113	6.2	$19,963.67	$2,255,895
Pike	64.3	195	5.9	$18,593.55	$3,625,743
Powell	65.7	39	4.8	$16,326.13	$636,719
Pulaski	60.5	161	5.5	$21,831.11	$3,514,809
Robertson	91.9	5	4.0	$8,744.40	$43,722
Rockcastle	64.6	41	5.5	$12,710.73	$521,140
Rowan	88.2	35	9.6	$23,663.31	$828,216
Russell	70.9	78	4.9	$15,532.27	$1,211,517
Scott	72.7	56	4.2	$14,513.39	$812,750
Shelby	118.5	46	5.7	$27,478.80	$1,264,025
Simpson	92.3	45	5.5	$13,786.24	$620,381
Spencer	63.1	21	4.8	$22,595.67	$474,509
Taylor	92.2	86	6.7	$17,583.19	$1,512,154
Todd	73.8	27	5.3	$11,803.81	$318,703
Trigg	66.3	37	5.2	$14,712.51	$544,363
Trimble	82.7	19	5.9	$23,805.58	$452,306
Union	101.3	39	4.4	$10,881.46	$424,377
Warren	80.4	292	5.4	$18,498.35	$5,401,519
Washington	82.9	30	5.1	$24,121.30	$723,639
Wayne	43.1	49	3.7	$14,654.02	$718,047
Webster	60.6	37	5.9	$18,649.57	$690,034
Whitley	69.5	123	5.7	$14,704.49	$1,808,652
Wolfe	83.9	28	6.3	$22,305.32	$624,549
Woodford	110.9	42	6.6	$23,940.90	$1,005,518

Appendix D

Adult risk factors by Kentucky Area Development District (2000–02)

Area Development District	High blood pressure	Current smoker	High cholesterol	Diabetic	Overweight (BMI 25.0+)	Physically inactive	Less than five fruits and vegetables a day
KENTUCKY	32.9%	32.3%	30.5%	7.5%	62.7%	31.3%	78.3%
Barren River	27.1%	31.2%	26.9%	6.8%	58.8%	33.9%	75.3%
Big Sandy	34.6%	34.3%	34.7%	8.8%	66.8%	44.0%	83.4%
Bluegrass	29.4%	30.1%	31.3%	5.5%	60.4%	26.3%	77.7%
Buffalo Trace	28.9%	33.0%	39.2%	6.4%	62.4%	36.9%	79.1%
Cumberland Valley	36.2%	35.6%	34.5%	8.3%	64.3%	41.9%	80.7%
FIVCO	34.4%	32.0%	32.2%	7.5%	65.8%	37.6%	81.5%
Gateway	32.9%	33.0%	31.4%	8.5%	61.2%	32.8%	82.1%
Green River	30.2%	32.3%	30.8%	7.4%	60.2%	30.6%	77.7%
Kentucky River	37.3%	35.8%	37.9%	9.7%	64.8%	40.5%	81.0%
KIPDA	27.6%	29.7%	29.5%	6.2%	63.6%	23.0%	79.5%
Lake Cumberland	34.1%	32.3%	31.7%	7.7%	60.5%	35.9%	79.1%
Lincoln Trail	25.8%	33.4%	27.0%	6.6%	61.5%	27.9%	76.5%
Northern Kentucky	27.8%	31.1%	31.8%	5.7%	60.9%	27.3%	79.6%
Pennyrile	32.1%	31.0%	28.5%	6.5%	64.3%	31.2%	78.8%
Purchase	32.6%	27.4%	36.0%	7.4%	58.2%	28.3%	78.1%

Appendix E

Adult risk factors clustering by Kentucky Area Development District (2000–02)

Area Development District	Number of risk factors							
	0	1	2	3	4	5	6	7
KENTUCKY	3.3%	15.5%	28.6%	27.4%	17.0%	6.4%	1.6%	0.2%
Barren River	4.5%	15.5%	30.8%	25.8%	15.0%	7.0%	1.5%	0.0%
Big Sandy	3.8%	9.8%	20.7%	31.2%	20.0%	11.1%	3.0%	0.4%
Bluegrass	5.2%	16.4%	26.7%	26.9%	18.0%	4.7%	1.6%	0.5%
Buffalo Trace	1.6%	12.7%	24.7%	37.3%	16.7%	6.0%	1.0%	0.0%
Cumberland Valley	1.9%	10.6%	27.6%	27.2%	22.1%	6.5%	3.8%	0.3%
FIVCO	0.8%	14.1%	28.1%	27.0%	23.3%	5.3%	1.2%	0.2%
Gateway	2.8%	17.8%	26.4%	27.5%	14.4%	8.2%	2.8%	0.1%
Green River	3.7%	14.5%	29.3%	25.2%	16.7%	8.4%	2.3%	0.0%
Kentucky River	3.2%	12.2%	23.7%	27.5%	17.1%	12.6%	3.6%	0.2%
KIPDA	1.4%	17.9%	32.6%	26.1%	15.6%	5.7%	0.8%	0.0%
Lake Cumberland	2.8%	11.9%	28.9%	28.5%	17.6%	7.7%	2.3%	0.4%
Lincoln Trail	3.3%	18.2%	29.0%	30.0%	12.8%	5.7%	0.9%	0.1%
Northern Kentucky	5.4%	15.8%	26.0%	28.5%	16.9%	6.2%	1.3%	0.0%
Pennyrile	2.5%	15.0%	30.8%	27.2%	17.2%	5.3%	1.8%	0.1%
Purchase	3.9%	15.0%	29.5%	28.2%	16.3%	6.1%	0.9%	0.1%

Appendix F

Behavioral Risk Factor Surveillance System (BRFSS) survey questions and definitions

Body mass index (2000–02)	• About how tall are you without shoes? • About how much do you weigh without shoes?
Physically inactive (2001–02)	• During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?
Fruit/vegetable servings (2000–02)	• How often do you drink fruit juices such as orange, grapefruit, or tomato? • Not counting juice, how often do you eat fruit? • How often do you eat green salad? • How often do you eat potatoes, not including French fries, fried potatoes, or potato chips? • How often do you eat carrots? • Not counting carrots, potatoes, or salad, how many servings of vegetables do you usually eat?
Diabetes (2000–02)	• Have you ever been told by a doctor that you have diabetes?
High blood pressure (2001)	• Have you ever been told by a doctor, nurse, or other health professional that you have high blood pressure?
High cholesterol (2001)	• Have you ever been told by a doctor, nurse, or other health professional that your blood cholesterol is high?
Current smoker (2000–02)	• Have you smoked at least 100 cigarettes in your entire life? • Do you now smoke cigarettes every day, some days, or not at all?
Heart attack signs and symptoms (2002)	• Do you think pain or discomfort in the jaw, neck, or back is a symptom of a heart attack? • Do you think feeling weak, lightheaded, or faint is a symptom of a heart attack? • Do you think chest pain or discomfort is a symptom of a heart attack? • Do you think pain or discomfort in the arms or shoulder is a symptom of a heart attack? • Do you think shortness of breath is a symptom of a heart attack?
Stroke signs and symptoms (2002)	• Do you think sudden confusion or trouble speaking is a symptom of a stroke? • Do you think sudden numbness or weakness of face, arm, or leg, especially on one side, is a symptom of a stroke? • Do you think sudden trouble seeing in one or both eyes is a symptom of a stroke? • Do you think sudden trouble walking, dizziness, or loss of balance is a symptom of a stroke? • Do you think severe headache with no known cause is a symptom of a stroke?
Heart attack/stroke response	• If you thought someone was having a heart attack or stroke, what is the first thing you would do?

Appendix G

Youth Risk Behavior Surveillance System (YRBSS) survey questions and definitions

Body mass index percentile (2003)	• How old are you? • What is your sex? • How tall are you without your shoes on? • How much do you weigh without your shoes on?
Physically inactive (2003)	• On how many of the past seven days did you exercise or participate in physical activity for at least 20 minutes that made you sweat and breathe hard, such as basketball, soccer, running, swimming laps, fast bicycling, fast dancing, or similar aerobic activities? • On how many of the past seven days did you participate in physical activity for at least 30 minutes that did not make you sweat or breathe hard, such as fast walking, slow bicycling, skating, pushing a lawn mower, or mopping floors?
Fruit/vegetable servings (2003)	• During the past seven days, how many times did you drink 100% fruit juices such as orange, apple, or grape? • During the past seven days, how many times did you eat fruit? • During the past seven days, how many times did you eat green salad? • During the past seven days, how many times did you eat potatoes? • During the past seven days, how many times did you eat carrots? • During the past seven days, how many times did you eat other vegetables?
At risk for diabetes (2003)	• Have you ever been told by a doctor or health care professional that you were at risk for getting diabetes?
Current smoking (2003)	• During the past 30 days, on how many days did you smoke cigarettes?

Notes

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